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NOTES ON A CYPRINODONT (*ORESTIAS AGASSIZII*) FROM CENTRAL PERU.*

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The specimens and notes which form the basis for this paper were sent the U. S. Bureau of Fisheries by Dr. S. Austin Davis of the Cerro de Pasco Mining Company, La Fundición, Peru. The fish were taken in March, 1909, and by careful treatment the brilliancy of their coloration has been well preserved.

Regarding their preservation, Dr. Davis writes: "I have tried to prepare them in such a way as to preserve their natural form, without shrinkage, their flexibility and brilliancy. At the moment of shipment I think I have succeeded fairly well. The process was as follows: They were placed, freshly caught and alive, in a solution of formalin 1–2000 and chloral hydrate 1–1000 and left for four to five days. The coagulated slime was then gently removed and the solution strengthened to 1–1000 formalin. This solution was removed weekly or as it became discolored. No alcohol or any other preservative used other than stated."

Describing the waters from which the specimens were obtained, Dr. Davis says:

"Approximately at the intersection of 11° S. lat. and 76° 10′ W. long., touching the N. E. corner of the great Pampa of Junin, with an elevation above the Pacific of 13,500 feet, there is a small plain. From the sides of the low range of hills which almost enclose it arise a few tiny rills. These join near the only break in the enclosure shortly to empty into a more con-

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siderable stream, the Huaracaca, itself finally uniting with the Montaro, which is the outlet of Lake Junin. The Montaro, through other streams, becomes part of the Ucayali, one of the larger tributaries of the Amazon. The initial rivulets first named, may thus be considered as the very headwaters of the Amazon from this district: and from these sources, which may be called La Fundición, come the fish in the parcel so marked.

"About three miles to the northeast is the shallow lake 'Angascancha,' elevation 14,200 feet, from which were taken the larger sort of fish as well as the smaller variety resembling those from La Fundición. The natural outlet of Lake Angascancha once discharged into the Huaracaca a short distance below the junction with the latter of the waters from La Fundición, but with the establishment a few years since of the smelting plant of the Cerro de Pasco Mining Co., the water from Angascancha is now siphoned over a low ridge to a reservoir for the use of the smelter. Fishes from Angascancha may now be found in the supply ditch and in the reservoir. Although fish from La Fundición and the smaller variety from Lake Angascancha are evidently of the same species, none of the larger sort is to be found in La Fundición; yet not long since there must have been easy communication between these waters. Kept in a glass aquarium, supplied with the weeds and running water in which they live naturally, the fishes from La Fundición keep in good condition indefinitely, while the larger fishes from Lake Angascancha, placed in the same aquarium, soon die.

"Of the larger sort of fishes from Lake Angascancha, a trial was made of their food qualities, but their bones are too hard. It may be stated that these might be softened by pickling, but even then the character of their food produces an inferior sort of flesh resembling that of mudsuckers."

The collection contains 65 specimens, 2 to 7.8 cms. long, from La Fundición, Peru, at an elevation of 13,500 feet in the extreme headwaters of the tributaries to the outlet of Lake Junin, in approximately 11° S. lat., 76° 10′ W. long. The streams are narrow but deep and ditch-like, with clean bottom, plenty of water plants, and clear, rather rapid current. By dissection, spawn was found in these fish in November, but none in February. The stomachs contained gnats in all stages, flies and water insects.

These little fish were plentiful and could be caught by hand. They are rather lively swimmers and get their food anywhere but from the bottom.

From Lake Angascancha we have 101 specimens, 2.9 to 10.1 cms. long.

Lake Angascancha is a shallow lake about 3 miles northeast of La Fundición and at 14,200 feet elevation. The bottom is of soft mud throughout and with plenty of water plants. The fish were very plentiful and easily caught by hand in the weeds. They feed on insects and vegetation. Their breeding season appears to be in mid-winter.

Orestias agassizii Valenciennes.

This species was first described by Valenciennes in Cuvier & Valenciennes, Hist. Nat. Poiss., XVIII, 178 (275), 1846. *O. tschudii* Castelnau, in Exped. Anim. Amer. Sud, 51, pl. 27, fig. 1, 1855; *O. owenii* (in part) Günther, Cat., VI, 330; *O. ortonii* Cope and *O. frontosus* Cope, in Journ. Phila. Ac. Sci., 2d series, VIII, 186, 1875, as stated by Garman, are probably synonymous names for this species. Prof. Garman in his Fishes and Reptiles of Lake Titicaca in Bull. Mus. Comp. Zool., III, 1–16, pp. 273–6, 1871–6 (1876), adds some additional notes and in "The Cyprinodonts" in Mem. Mus. Comp. Zool., XIX, No. 1, 1895, describes the species more in detail. Pellegrin in Notes on the Fishes of Lakes Titicaca and Poopo, in Soc. Zool. France, XXIX, 90–6, 1904, attempts to subdivide the species into four varieties based on their coloration and reinstates *O. tschudii* indicating that the latter has more dorsal and anal rays, more scales in lateral line and a difference in the size of the eggs. The specimens of *O. tschudii* upon which he bases this distinction are larger than the specimens of *O. agassizii* with which he compares them. In his "Les Poissons des Lacs des Hauts Plateaux de l'Amerique du Sud," pl. XIV, figs. A–D, 1907, he figures the four varieties of *O. agassizii*. Starks in a paper entitled "On a collection of Fishes made by P. O. Simons in Ecuador and Peru," in Proc. U. S. Nat. Mus., XXX, 780, 1906, calls attention to the variability of scaling on the area in front of pectoral and the fact that in his specimen the head was longer than stated by Garman.

For purposes of comparison we give comparative measurements of a series of 10 specimens from Lake Angascancha, 5 from La Fundición, 2 from Lake Titicaca (collected by Dr. R. E. Coker) and one specimen from Bolivia (U. S. Nat. Mus. No. 53,516).

Lake Angascancha Specimens.

	Length in cms.	Head in length	Depth in length	Eye in head	Snout in head	Inter-orbital in head	D.	A.	Scales in L. l.
1	10.1	3.30	4.10	4.14	4.13	3.10	14	15	32
2	9.6	3.63	4.70	4.88	4.00	3.38	13	14	34
3	9.0	3.42	4.05	3.50	4.03	3.50	13	14	32
4	8.9	3.57	4.20	3.17	4.00	3.33	14	15	31
5	8.8	3.40	4.29	3.41	4.10	3.01	13	14	33
6	8.7	3.33	4.26	3.80	4.04	3.00	13	14	31
7	8.0	3.40	4.25	4.87	4.06	3.25	14	13	33
8	7.7	3.05	3.81	3.44	4.00	3.33	13	14	30
9	6.0	3.76	4.90	3.51	3.71	3.17	13	13	
10	5.4	3.54	4.25	3.42	4.00	3.00	13	14	32

Lake Titicaca Specimens.

11	7.0	3.56	3.45	4.00	4.00	3.00	14	15	31
12	6.7	3.37	3.00	4.00	4.00	2.90	14	15	32

La Fundición Specimens.

13	8.0	3.42	4.06	3.95	3.95	3.16	14	14	33
14	6.9	3.27	3.85	4.12	4.12	3.43	14	15	33
15	5.4	3.38	4.40	4.00	4.33	3.25	14	16	32
16	4.2	3.23	4.25	3.62	3.62	3.27	14	15	30
17	2.2	3.60	5.14	2.63	3.33	2.63	13	14	

U. S. Nat. Mus. Spec. No. 53,516, from Bolivia.

18	16.5	3.77	3.08	4.80	3.27	2.66	15	15	34

The scales in the largest specimens are large, convex, horny and smooth anteriorly, becoming smaller, flattened and finely striate posteriorly; those above pectoral and on sides and top of head are polished; those on sides of caudal peduncle more or less deciduous in some specimens; breast and belly naked; top of snout and an area around eye, more or less scaleless. Scales in transverse series 14 or 15; 20 on median line of back between nape and origin of dorsal; those on cheek arranged in 3 or 4 rows. In young individuals, the scales are all very thin, finely striate and not polished.

Head and shoulders broad, heavy and arched in adults, much more compressed in the young; mouth small, nearly vertical; cleft of mouth extending to lower level of orbit. This character is subject to considerable variation; in adults it may reach a considerable distance below level of orbit. Jaws with two series of small, simple, conical, hooked teeth; those in the inner row fewer and smaller; in young examples often none or only one or two of the inner series visible.

Origin of dorsal in advance of anal, slightly nearer caudal than base of occiput, situated at distance equal to its base from caudal; caudal truncate or slightly rounded; ventrals absent.

Color in spirits: 20 specimens 5.5 to 10.1 cms. long, from Lake Angascancha and 10 specimens, 5.0 to 7.6 cms. long, from La Fundición, are dusky olive on back and sides; ventral surface white or yellowish-white, the duskiness of the sides encroaching on this area in the older examples; in some specimens some of the scales on sides, especially on the head

and caudal peduncle have light centers with dusky edges. Some of the La Fundición specimens have a broad indistinct dark band on sides, margined below with yellow; dorsal and anal dusky, without black areas or blotches; base of dorsal usually jet black; caudal and pectoral dusky to lightish, axil and base white or dusky white, margined with dusky. All of our specimens over 6.0 cms. long have this coloration, and are Pellegrin's var. *inornata*.

Two specimens, 4.1 to 4.3 cms. long, from Lake Angascancha resemble closely the preceding but differ in having a black line from opercle to base of caudal, most distinct on caudal peduncle; body below line yellowish white with occasional very slight traces of dusky; dorsal and caudal with a few irregular black areas on rays near base, giving the fin a punctulated appearance. These agree quite closely with the description and figure of Pellegrin's var. *typica*.

Thirteen specimens, 2.8 to 5.0 cms. long, from Lake Angascancha differ from those just described in having the horizontal line darker and a row of about a dozen irregular black spots along each side of the back; occasionally two of these meet forming a saddle across the back; below these and alternating with them in some specimens there is a second row; the dark blotches on dorsal and caudal are more pronounced and extend nearer to the free margin. These agree quite closely with Pellegrin's description and figure of var. *senechali*.

Seven specimens, 3.4 to 6.0 cms. long, from Lake Angascancha and 9 specimens, 2.6 to 5.9 cms. long, from La Fundición have the ground color much lighter with 3 or 4 rows of irregular dusky or black blotches on sides, those replacing the horizontal line often more or less coalescent especially posteriorly; in some specimens the dorsal and caudal are only lightly dotted with dusky, in others the spots are almost jet black; pectoral and anal as a rule are much lighter colored in these specimens. The fishes taken at Lake Angascancha are much darker than those from La Fundición. Pellegrin's description and figure of var. *crequii* appears to agree very well with these.

Ten specimens, 2.4 to 5.4 cms. long, from Lake Angascancha and 42 specimens, 2.0 to 6.0 cms. long, from La Fundición are intermediate between the first and fourth lots just described, *i. e.*, between Pellegrin's var. *inornata* and var. *crequii*. Some of these show very obscure traces of spots on back, and have a few dusky spots on dorsal and caudal; others differ from var. *inornata* only in having a few spots either on dorsal or caudal or on both. There are so many varying stages among these that we are unable to separate them.

Two specimens, 3.7 and 4.4 cms. long, from Lake Angascancha and 2 specimens, each 4.3 cms. long, from La Fundición are intermediate between the second and third lots described, showing posteriorly very obscure traces of two or three dusky blotches. These are intermediate between var. *typica* and var. *senechali* of Pellegrin.

Forty-seven specimens, 4.2 to 5.9 cms. long, from Lake Angascancha and 2 specimens, 4.0 and 4.6 cms. long, from La Fundición are intermediate between our third and fourth lots, *i. e.*, between Pellegrin's var. *senechali*

and var. *crequii*. In some of these the black spots on sides have become coalesced to such an extent that they form three parallel black bands with two alternating light bands between them; the central black band typical of Pellegrin's var. *typica* is wider and more pronounced in color in these specimens. Others have dusky or black spots below black lateral stripe.

We have examined also two examples of this species collected in Lake Titicaca near Puno, July 28, 1908, by Dr. Robert E. Coker. They are not so slender as our specimens and it is probable, as is indicated in the table of comparative measurements, that the head and depth are more nearly equal in living examples of this size. They have the general coloration of our specimens over 6.0 cms. long but the dorsal and caudal are punctulate with darker. In the smaller one there is a dusky line bordered on either side with white, passing through the center of the dorsal fin.

After careful study of these specimens, in all of which the colors have been well preserved, we feel confident that specimens of *Orestias agassizii* from this region will not admit of such a separation as that offered by Pellegrin. That different conditions markedly affect their brilliancy of coloration is evidenced by the specimens in our collection. The young (under 6.0 cms.) from shallow Lake Angascancha with still water and mud bottom are much darker than those of the same size taken from the clear, narrow, deep and rapid streams around La Fundición. The latter do not show such marked differences and tend to conform much more closely to the adult in color and general appearance.